STATE-OF-THE-ART
OF COOPERATIVE INTELLIGENT TRANSPORT SYSTEM (ITS)
DEPLOYMENT IN VERONA

Citation

Authors
Vecchietti Arnaldo, Director of EU Resources & Quality of Internal Services Department, City of Verona, Italy
Pezzuto Bruno, Expert Architect, responsible for the municipal Traffic Control Room and Telecommunication Systems, City of Verona, Italy
Alcaraz Gonzalo, responsible at SWARCO Mizar S.p.A. for the management of R&D and industrial projects related to deployment of C-ITS (Cooperative Intelligent Transportation Systems), Verona, Italy.

Submitted: January 23, 2015; Accepted: February 03, 2015; Published: February 15, 2015

Abstract
The article is devoted to the analysis of the development and implementation of Intelligent Transport System (ITS) in Verona which is considered as a key and strategic measure to carry into effect the sustainable mobility objectives promoted by the General Transportation Plan (2001) and the Guidelines for the General Mobility Plan (2007). It is presented the range of various applications in the field of ITS in which the Municipality of Verona invested considerable economic resources in the last few years, thus setting about for a complex and technologically advanced integrated system for mobility and security road management. The SWOT risks and opportunities analysis was used to highlight the main strengths, weaknesses, opportunities and threats considered at local level for the actions ensuring safety on roads. To a better understanding of the complex decision-making process used by the Municipality of Verona in order to launch the different initiatives, assess their results in terms of environmental, economical, social and cultural impact, and coordinate the whole, the logical framework and flow chart are developed.

Stato dell'arte di un Sistema coordinato di Trasporto Intelligente (ITS) in fase di attuazione a Verona

Vecchietti Arnaldo, Pezzuto Bruno, Alcaraz Gonzalo

Verona, Italia

Abstract
L'articolo è dedicato all'analisi dello sviluppo e dell'implementazione di un Sistema di Trasporto
Intelligente (ITS) a Verona, considerato come fondamentale e strategico per porre in atto gli obiettivi di mobilità sostenibile promossi dal Piano Generale dei Trasporti (2001) e dalle linee guida per il Piano Generale della Mobilità (2007). Viene presentata la gamma delle diverse applicazioni nel campo dei Sistemi di Trasporto Intelligenti nei quali il Comune di Verona ha investito notevoli risorse economiche in questi ultimi anni, mettendo così su un sistema integrato complesso e tecnologicamente avanzata per la gestione della mobilità e della sicurezza stradale. L’analisi SWOT dei rischi e opportunità è stata utilizzata per mettere in evidenza i principali punti di forza, di debolezza, opportunità e minacce valutate a livello locale per le azioni che garantiscono la sicurezza sulle strade. Il quadro logico e il diagramma di flusso sono sviluppati per una migliore comprensione del complesso processo decisionale utilizzato dal Comune di Verona al fine di porre in atto le diverse iniziative, valutarne i risultati in termini di impatto ambientale, economico, sociale e culturale, e coordinare il tutto.

Keywords
Road safety management, sustainable mobility, transport infrastructure, cooperative mobility projects, SWOT risks and opportunities analysis

Introduction

In order to improve urban mobility, according to the European Commission Agenda and the national strategies for ITS directives, Verona is moving fast to deliver solutions to the new challenges, emerging in the recent years with respect to climate change, energy policy, air quality legislation and the difficulties of tackling congestion in urban areas. In October 2008, the City of Verona joined the Covenant of Mayors, sponsored by the European Commission as part of the Campaign for Sustainable Energy in Europe. In April 2011, the Environmental Energy Plan was adopted, giving guidelines and strategic objectives in the field of energy. In October 2011 the Action Plan for Air Quality Management & Remediation was approved, as the result of a two-year work made by a municipal technical staff, technically and scientifically supported by the University of Trento, ARPAV of Health Units, and 17 municipalities that joined the agreement. This Plan provides for the adoption of structural measures to counter air pollution. Among many factors considered, one of the main things taken into consideration was mobility. Simulations and previous experiences in Verona regarding mobility aspects have shown that, under normal traffic flow conditions, i.e. balanced benefits for both drivers and road operators, the following achievements are possible:

- • -32% Stops / vehicle
- • -34% Stop Time / vehicle
- • +18% Traffic Flow
- • -12% Travel Time

Achieving sustainable implementation

Development & implementation of ITS: ensuring safety on roads

The development & implementation of ITS in Verona is considered as a key and strategic measure to carry into effect the sustainable mobility objectives promoted by the General Transportation Plan (2001) and the Guidelines for the General Mobility Plan (2007). In 2014, the Municipality of Verona encouraged the involvement of some of the neighbouring small municipalities in a common Action Plan, and besides, together with the corresponding public authorities of the other chief towns in Veneto Region, took part in the preliminary works for the Regional Operational
Programme / ERDF, suggesting priorities to the next regional planning document, in order to contribute to
the definition of the specific regional objective concerning the implementation before 2023 in the seven
Veneto chief towns of ITS applications for:
- traffic and related infrastructure management
- local public transport management
- customers information
- road pricing
- electronic ticketing and fares integration
- goods transportation and road safety management.

Other regulations giving direction to the operational activity of the Municipality of Verona are:
- Directive 2010/40/EU (7 July 2010), General Framework for the dissemination of ITS and other
transportation interfaces;
- Italian Law Decree n.179 (18 October 2012), converted and modified from Law no.221 (17
December 2012) concerning Further urgent measures for the Countries growth, according to art.8
Measures for Transportation Systems Innovation;
- Interdepartmental Decree, 1st Feb. 2013, Dissemination of Intelligent Transport Systems – ITS in
Italy, being the methodological and operational basis for the National Action Plan adopted on 12th
Feb. 2014 by the Ministry of Infrastructure and Transportation.

Under this regulations framework, the City of Verona will implement the following actions in the next
years:

a. Optimum use of data concerning roads, traffic and mobility:
   i. Database with traffic/mobility information;

b. Continuity of ITS service to manage traffic and goods transportation:
   i. Promoting the creation of logistics platforms (integrated or inter-operating with the National Logistics
      Platform UIRNet) in proximity of traffic junctions;
   ii. Encouraging the use of ITS for a multimodal management of transportation and logistics, using open
      or interoperating platforms;
   iii. Encouraging the use of ITS for people mobility management in a multimodal prospect (which means
      considering TPL, private means, alternative transport means), using open or interoperating platforms;
   iv. Encouraging the adoption of electronic ticketing, both at integrated and inter-operating level, for TPL
      service payment;
   v. Encouraging ITS use in local public transportation;
   vi. Conditions allowing Smart Mobility in urban and extra-urban areas;

c. ITS applications for road security and transportation security:
   i. Dissemination of ITS systems for dangerous goods management and monitoring;
   ii. Encouraging the dissemination of enforcement systems (access control and monitoring of driver’s
      behaviour);
   iii. Promotion of advanced on-board systems;

d. Connection between vehicles and transport infrastructure:
   i. Monitoring of infrastructure and safe parking areas for goods transportation conditions;
   ii. Technical specifications and standardization for connection between vehicles (V2V) and between
      vehicles and infrastructure (V2I) for cooperative driving;
   iii. Monitoring of road infrastructure conditions in unfavourable weather circumstances, also for
      maintenance.

Verona, according to the EU and national regulations above mentioned, is pursuing the aim of
implementing a sustainable mobility system, and this will be achieved by reducing private vehicles traffic
while increasing local public transport (TPL) ways, through specific actions, directed both to provide the
customers with all the information necessary to plan their displacements and to stimulate intelligent
intermodal systems.

Current projects

- Cooperative Mobility Pilot on Safety and Sustainability Services for Deployment: Compass4D
The EC-funded project Compass4D focuses on three services which will increase drivers’ safety and comfort, with the aim of both reducing the number and severity of road accidents and avoiding queues and traffic jams. Compass4D will also have a positive impact on the local environment by reducing CO2 emissions and fuel consumption. Verona is the largest pilot site of the project, involving all urban intersections, and one of the first and important reference cities in Europe implementing C-ITS services over LTE.

The main focus is on the vehicles used by citizens moving everyday around the city. The project provides an opportunity for citizens to use a dedicated App (see picture 1), giving speed advice for green light, remaining stop time at intersections and warnings about incidents, road-works and traffic jams. In addition, a number of buses will be equipped to implement a public transport priority service in one of the main corridors of the city. In a future perspective, the city intends to improve the services and add new functionalities such as Parking information, In-vehicle signage and personalized routing to the services provided by Compass4D.

![Picture1. Examples of the Compass4D mobile App](image)
The following SWOT analysis was used to highlight the main strengths, weaknesses, opportunities and threats considered at local level for Compass4D implementation.

**Factors useful to objectives achievement**
- Ownership of road infrastructure
- Respect of national regulations
- Capacity of control by regulations
- Municipal operational capacity
- Need of service improvement and waste reduction
- Selling of traffic data

**Factors damaging to objectives achievement**
- Poor resources for maintenance
- Organizational fragmentation
- Non definition of costs distribution mechanisms
- Non preliminary estimation of actions advantage
- Non definition of expected results for air conditions improvement

**SWOT analysis, Risks & Opportunities related to the implementation of COMPASS4D in Verona**

**COMPASS4D** final results will be soon assessed during the next international project meeting, followed, in a near future, by the signature of a written agreement between the City and fleet operators, involved to assure the project sustainability.

- Smart communities, the weakest people protection and the data sharing: networking in partnership: CityPASS

The Municipality of Verona (coordinator: Mobility and Traffic Dept.; information systems support: Information Systems & E-Government Dept.; specific support: Municipal Police Dept.) has been the only municipality in Italy since 2009 putting at the disposal of all the municipalities in its province the platform CityPASS Web. This platform allows the emission of European check marks;

The platform allows the management of marks for disabled people, offering a useful service to the citizens and, at the same time, encouraging their displacement in the territorial area and in the Restricted Access Area, where electronic detectors check the points of access.
The project *CityPASS* represents an integrated system shared by 85% of partnering municipalities in the Province of Verona, and covering 90% of the resident population. This important result won the City a special award and the sponsorship by the National Association of Italian Municipalities – ANCI.

- **Advances technology for vehicles monitoring and energy efficiency:** Radio Frequency Identification (RFID) in Restricted Access Areas (ZTL)

  On 1st Jan 2013, new traffic marks were introduced in Verona; they are based on TAG RFID (UHF, passive) technology, for vehicle monitoring by means of an innovative control system with a record made of the inputs and outputs.

  This system, implemented for the first time in Italy, allows precise monitoring of vehicle stay – only commercial vehicles in a first phase – inside the Restricted Access Area (ZTL), to reduce goods traffic and polluting substances emission.

  The control system got the authorization by the Italian Data Protection Authority and become officially operative last 15th Sept, causing the immediate light goods traffic reduction of about 50%.

- **Integrated systems and energy efficiency for Smart lands:** Network ZTL

  By Deliberation no.197/2013, the Veneto Region Board of Politicians approved a Protocol of agreement between Veneto, ANCI Veneto (Association of Municipalities in Veneto Region) and Veneto chief towns, to simplify and standardize the access modalities in restricted access areas.

  After signature of this protocol of agreement, on 19th July 2013, a work group was built among the partners and, during the meeting on 15th Nov 2013, a technical board was established, composed by information systems members from the signatory authorities, to identify one regional solution for these areas access.

  The deriving information exchange represents a useful practice not only for the owners of transportation means like taxies and hire-with-driver means, but also for disabled citizens service, for marks checking, emplacements control, reserved parking areas control. Consequently, illegal and unauthorized actions will be more easily checked.

  This project will be presented to the Interregional Centre for Information, Geographical and Statistical Systems (CISIS) to become an important reference initiative also at national level, offering a replicable model to the other regions. If applied on national scale, this project would allow sharing information on the whole national territory.

- **Info-mobility on territorial scale (smart communities): Veronamobile.it**

  The info-mobility portal of the Municipality of Verona is being implemented, and will be extended to the provincial network (already experienced for the project *CityPASS*) and based on a shared data architecture using European standard protocols like DATEX.II.

  The main objective of this project is to provide public stakeholders, especially in small municipalities, with a tool for a simplified collection of information about events etc, and easy data export to other integrated platforms.
The local decision-making process

To a better understanding of the complex decision-making process used by the Municipality of Verona in order to launch the different initiatives, assess their results in terms of environmental, economical, social and cultural impact, and coordinate the whole, you can find the visualization of the main topics through the logical framework below.

Verona’s challenge is to effectively share its experience, driven by a strong motivation that specific awareness increase must be seen in a wider context, therefore out of the municipal boundaries, with the involvement of the neighbouring small municipalities, to develop extensive specific policies.

Verona’s experience: sharing with other cities, implementation of European directives

The City of Verona shares with the other chief towns of Veneto region the goal of activating common projects about ITS, in the framework of the Regional Operational Plan (POR)/ ERDF /Veneto 2014-2020, applying for funding as foreseen by Axis 6 “Sustainable Urban Development”. The deadline for the project application is November 2015.

The City of Verona is about establishing, together with seventeen small municipalities of the surrounding belt, an agreement called “Wide Area Programme Agreement”, dealing with different topics and among
them, the mobility in the Wide Area, including actions for ITS systems implementation.
The City of Verona considers as extremely important the topic of ITS in all networks where she takes part to. Besides, the City is strongly engaged in promoting ITS also encouraging the dissemination of project results (e.g. Compass4D).
The Municipality of Verona invested considerable economic resources in the field of ITS in the last few years, thus setting about for a complex and technologically advanced integrated system for mobility and security management, which is at the moment already working at provincial level.
A new application called “City Supervisor” has recently been implemented at the Mobility Control Room. The “Supervisor” represents the new frontier for mobility control rooms, being an updated tool for systems integration, cooperation between different control rooms and access to historical and dynamic data about traffic congestion.
Following to this approach based on the sharing and the communication in the smart city, the experience is consequently opened to a size of smart community and smart land, naturally evolving from the provincial level to the regional level.
This is why we can say that Verona has been pursuing strategies related to smart cities (as for mobility, info-mobility, road safety, environment protection) for quite a long time.
A specific set of experiences, a well-developed communication network, measures for the integration between private and public fields as well as between provincial and regional contexts, make the Municipality of Verona as the main actor strongly engaged on important issues, where also the deployment of advanced technology allows a considerable social impact.

Conclusions

The ongoing improvement of ITS infrastructure represents the effort of Verona to relieve those issues mainly related to traffic congestion, including the updating of technology and wireless service used, information development, roads surveillance increase, emergency systems installation. All these measures will be part of a larger strategy towards a smart city prospect.

1 Arnaldo VECCHIETTI: Director of EU Resources & Quality of Internal Services Dept. Degree in Political Sciences (economics and social issues-oriented) at the University of Padua, Degree in History (geography-oriented) at the University of Bologna, Master in business organization at the University of Bologna, Postgraduate in System Dynamics at the University of Barcelona, Master in Quality Assurance in Internal Assessment at the University of Ferrara, Italy.

2 Bruno PEZZUTO: PArchitect, responsible for the municipal Traffic Control Room and Telecommunication Systems. In charge of Verona ITS infrastructure management, he develops innovative projects in the framework of mobility to support road security and mobility information system.

3 Gonzalo ALCARAZ: graduated in Telecommunication Engineering at Universidad Blas Pascal (Argentina), holds a specializing master in Wireless Systems from Politecnico di Torino (Italy) and is currently doing a Master in Business Administration (MBA) at Blekinge Institute of Technology (Sweden). During the last years, he has been involved in several EC-funded projects such as EBBITS, COSMO (Technical Leader), COMPASS4D (Pilot Site Leader). At present, he is responsible at SWARCO Mizar for the management of R&D and industrial projects related to deployment of C-ITS (Cooperative Intelligent Transportation Systems).